CLAIMS

What is claimed is:

1. An integrated lead suspension, comprising:

a tail having a plurality of conductors, each of the conductors having a first end extending from a head area, and a second end with an axis, such that the tail supports the second ends of the conductors, the tail further comprising:

a support layer having at least one aperture formed therein for allowing the second ends of the conductors to move independently with respect to other ones of the second ends of the conductors; and

an insulation layer formed between portions of the conductors and the support layer for preventing contact therebetween.

2. The integrated lead suspension of claim 1, wherein the support layer defines a plane, and wherein the second ends of the conductors are free to move out of the plane independently with respect to the other ones of the second ends of the conductors.

3. The integrated lead suspension of claim 2, wherein the second ends of the conductors bend independently with respect to the other ones of the second ends of the conductors.

4. The integrated lead suspension of claim 1, wherein each of the second ends of the conductors are free to twist about their respective axes independently with respect to the other ones of the second ends of the conductors.

5. The integrated lead suspension of claim 1, wherein each of the second ends of the conductors are free to gimbal in at least two degrees of freedom with respect to the other ones of the second ends of the conductors.

6. The integrated lead suspension of claim 1, wherein the at least one aperture is a single rectangular opening formed in the support layer for accommodating independent movement of all of the second ends of the conductors.

7. The integrated lead suspension of claim 1, wherein the at least one aperture formed in the support layer comprises a plurality of apertures, each of which accommodates independent movement of one of the second ends of the conductors.

8. The integrated lead suspension of claim 1, wherein the at least one aperture is a single asymmetrical opening that is contoured to a shape of all of the second ends of the conductors to define a plurality of apertures for accommodating independent movement of all of the second ends of the conductors.

9. The integrated lead suspension of claim 8, wherein the support layer has a plurality of fingers, each of which extends into one of the plurality of apertures for providing additional support for a respective one of the second ends of the conductors, such that the fingers are impedance groomed with respect to the second ends of the conductors.

10. The integrated lead suspension of claim 1, wherein the insulation layer has an opening and a plurality of insulation pads formed in the opening for preventing contact between the support layer and the second ends of the conductors.

11. A head gimbal assembly, comprising:

a mounting device;

an integrated lead suspension mounted to the mounting device and having a read/write head, a tail, and a plurality of conductors, each of the conductors having a first end electrically interconnected with and extending from the read/write head, and a second end with an axis, such that the tail supports the second ends of the conductors, the tail further comprising:

a support layer having at least one aperture formed therein for allowing the second ends of the conductors to move independently with respect to other ones of the second ends of the conductors; and

an insulation layer formed between portions of the conductors and the support layer for preventing contact therebetween.

12. The integrated lead suspension of claim 11, wherein the support layer defines a plane, and wherein the second ends of the conductors are free to move out of the plane independently with respect to the other ones of the second ends of the conductors.

13. The integrated lead suspension of claim 12, wherein the second ends of the conductors bend independently with respect to the other ones of the second ends of the conductors.

14. The integrated lead suspension of claim 11, wherein each of the second ends of the conductors are free to twist about their respective axes independently with respect to the other ones of the second ends of the conductors.

15. The integrated lead suspension of claim 11, wherein each of the second ends of the conductors are free to gimbal in at least two degrees of freedom with respect to the other ones of the second ends of the conductors.

16. The integrated lead suspension of claim 11, wherein the at least one aperture is a single rectangular opening formed in the support layer for accommodating independent movement of all of the second ends of the conductors.

17. The integrated lead suspension of claim 11, wherein the at least one aperture formed in the support layer comprises a plurality of apertures, each of which accommodates independent movement of one of the second ends of the conductors.

18. The integrated lead suspension of claim 11, wherein the at least one aperture is a single asymmetrical opening that is contoured to a shape of all of the second ends of the conductors to define a plurality of apertures for accommodating independent movement of all of the second ends of the conductors.

19. The integrated lead suspension of claim 18, wherein the support layer has a plurality of fingers, each of which extends into one of the plurality of apertures for providing additional support for a respective one of the second ends of the conductors, such that the fingers are impedance groomed with respect to the second ends of the conductors.

20. The integrated lead suspension of claim 11, wherein the insulation layer has an opening and a plurality of insulation pads formed in the opening for preventing contact between the support layer and the second ends of the conductors.

21. A hard disk drive, comprising:

an enclosure;

a disk pack assembly mounted to the enclosure and having a media storage disk that is rotatable relative to the enclosure;

an actuator movably mounted to the enclosure and having a head gimbal assembly including an integrated lead suspension, a read/write head, a tail extending from the integrated lead suspension, and a plurality of conductors, each of the conductors having a first end electrically interconnected with and extending from the read/write head, and a second end with an axis, such that the tail supports the second ends of the conductors, the tail further comprising:

a support layer defining a plane and having an asymmetrical opening that is contoured to a shape of all of the second ends of the conductors to define a plurality of apertures for accommodating independent gimbal movement of each of the second ends of the conductors, such that each of the second ends of the conductors have at least two degrees of freedom with respect to other ones of the second ends of the conductors; and

an insulation layer formed between portions of the conductors and the support layer for preventing contact therebetween.

22. The hard disk drive of claim 21, wherein each of the second ends of the conductors are free to move out of the plane independently with respect to the other ones of the second ends of the conductors.

23. The hard disk drive of claim 21, wherein each of the second ends of the conductors are free to bend independently with respect to the other ones of the second ends of the conductors.

24. The hard disk drive of claim 21, wherein each of the second ends of the conductors are free to twist about their respective axes independently with respect to the other ones of the second ends of the conductors.

25. The hard disk drive of claim 21, wherein the support layer has a plurality of fingers, each of which extends into one of the plurality of apertures for providing additional support for a respective one of the second ends of the conductors, such that the fingers are impedance groomed with respect to the second ends of the conductors.

26. The hard disk drive of claim 21, wherein the insulation layer has an opening and a plurality of insulation pads formed in the opening for preventing contact between the support layer and the second ends of the conductors.

27. A method of terminating an integrated lead suspension, comprising:

(a) providing an integrated lead suspension having a tail and a plurality of conductors, each of the conductors having an end with an axis;

(b) supporting the ends of the conductors with the tail, such that the ends of the conductors are free to move independently with respect to other ones of the ends of the conductors;

(c) biasing the tail toward an arm electronics cable having a plurality of pads that correspond to the plurality of conductors;

(d) allowing independent movement of each of the ends of the conductors to make contact with respective ones of the pads; and

(e) terminating the ends of the conductors to the respective ones of the pads.

28. The method of claim 27, wherein step (d) comprises a bending of the ends of the conductors out of a plane defined by the tail with respect to the other ones of the ends of the conductors.

29. The method of claim 27, wherein step (d) comprises a twisting of the ends of the conductors about their respective axes independently with respect to the other ones of the ends of the conductors.

30. The method of claim 27, wherein step (d) comprises a gimbaling of the ends of the conductors in at least two degrees of freedom with respect to the other ones of the ends of the conductors.

31. The method of claim 27, wherein step (a) comprises providing the tail with an opening that is contoured to a shape of all of the ends of the conductors to define a plurality of apertures for accommodating independent movement of all of the ends of the conductors, and a plurality of fingers, each of the fingers extending into one of the plurality of apertures for providing additional support for a respective one of the ends of the conductors.

32. The method of claim 31, further comprising the step of impedance grooming the fingers with respect to the ends of the conductors.